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EQUALITY OF NMR RELAXATION TIMES FOR DIFFERENT MOLECULAR MODELS

James McConnell, Dublin Institute for Advanced Studies, Dublin 4

Expressions for nuclear magnetic relaxation times and for dielectric permittivity derived for sphereical molecules are applicable in rotational diffusion theory to linear and symmetric top molecules. This holds for nuclear magnetic relaxation by intramolecular dipolar interaction, quadrupolar interaction or anisotropic chemical shift, provided that in the latter two cases the interactions have axes of cylindrical symmetry which are parallel to the axes of rotational symmetry of the molecule.
The theorem is proved by deriving equations for ensemble average of the rotation operator $\langle R(t) \rangle$ associated with the molecule, and then showing that the dielectric permittivity and relaxation times depend only on $\langle R(t) \rangle_{00}$, where the suffixes denote the 00 - matrix element with resepct to spherical harmonics as basis.

1) J. McConnell, Physica 138A, 367-381 (1986).